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Strategies of product innovation and differentiation do lead to higher wages: an empirical investigation in the Brazilian industry

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1. Objective

Pertinent and relevant literature, at least since Schumpeter's, associates innovation with firms' growth and competitiveness. Higher wages in central economies are many times associated with the higher technological pattern or, more specifically, with the ability – or capability – to innovate and differentiate products. Based on large Brazilian official databases that respect international methodology (for instance, compatible with European CIS – Community Innovation Survey), representing around 95% of the Brazilian industrial value added, the paper investigates whether firms that perform product innovation and differentiation strategies present better wages and better work conditions; moreover, the aim is to measure the relationship innovation – wages. By the other side, economies in development – or emergent, usually have a lower innovation dynamics. So, a second question arises: can the relationship "innovation and product differentiation x wages premiums" be verified also in developing economies?

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In order to do so, we defined three categories of firms, regarding their effective strategy measured by data: firms that innovate and differentiate product; b) firms specialized in standardised products but with high productivity; c) firms without product differentiation and with lower productivity. An econometric model was built in order to analyse the correlation innovation and product differentiation with wage premiums, by processing microdata of each firm. In that sense, our research is basically empirical, the largest empirical investigation ever realised on the subject in Brazil, perhaps in the world. It comprises 72.000 industrial firms with more than 9 workers, representing more than 95% of the industrial value added in the country, and 5 million industrial workers.

2. The discussion on wage differentials and our main research hypothesis

Krueger and Summers (1986) have pointed out empirical evidences of wage differentials in the US industry. The sectors that paid higher wages in 1923 were still paying higher wages in 1984; the same happened to the sectors with lower wages. Comparing 1915 with 1984, there is a high and positive correlation (from 0,76 to 0,98) of the same industrial sectors with the highest wages. The authors conclude by the rigidity of the American wage structures along the decades; there is not a trend towards relative industrial wage in the US, the dispersion being counter-cyclical. The same seems to happen when the comparison involves developed countries. Looking at the characteristics of workers and firms, the evidence showed that same firms pays high wages and other pays low wages for workers with the same characteristics. There are also evidences showing that forms in more concentrated markets, more capital intensive, with higher revenues, tend to pay higher wages. Those data suggest that the American industrial tissue presents systematic differentiation by sector. In other words, there is room for policies with sectoral focus, beyond the traditional horizontal approach.

Arbache and De Negri (2004) showed a similar structure of wage differentials in Brazil. One of the objectives of our paper is to search for an empirical evidence for the existence of a similar structure in the Brazilian industry according to the three categories of firms' strategies.

These wage differentials gather some explanations. Some considers it caused by non-measurable characteristics, as work conditions; others, by measurable factors linked to work productivity. Katz and Summers (1989b) argue for the equivoque of the first explanation, otherwise market forces would reduce the differences along time.

Stiglitz (1987) proposes the idea of wage-efficiency that would explain wage differentials. There would be product characteristics according to its price, not only related to a production function. It means a room for a firm to pay better wages in order to have more productive workers, and the firm would be more competitive. Better wages would lead to more efficiency and more returns to the firm. In that sense, the economic equilibrium could be obtained without market-clearing: for instance, unemployment and wage differentials could be verify at the same time in economic equilibrium. That higher efficiency would be explained by four main reasons. Firstly, the existence of an adverse selection in the job market is considered, that is, more productive workers would tend to have better job offers from other companies. It makes sense for the company paying more to that employee in relation to the other companies to retain a more productive worker. One variation of such explanation occurs when there are specific job abilities in a certain company and positive costs on recruiting other workers.

In the second one, it is considered that the more qualified and complex the job (or tasks) performed by a worker is, the more difficult it is for the employer to check the execution and the quality of such task. That way, the employer would find economical sense in paying that qualified worker better, trying to preventing this employee from being little productive due to

waste of time with non-productive and hard-to-check activities. In the third one, it is considered that there are costs for the company to train the worker (either formally or informally). That way, loosing the employee or having to keep a high rate of workforce turnover would be detrimental to productivity. The worker would receive higher salaries and/or higher job stability due to this third factor. In the fourth one, it is considered if there are moral or sociological effects which are associated to a better wage. That is, a better paid worker would not only obtain a higher satisfaction from his/her job, but would also be motivated to be more dedicated. Thus, his/her positive participation, giving higher attention to the job (making fewer mistakes) and pursuing the improvement of his/her functions would lead to a higher productivity, justifying higher wages/salaries.

Why wouldn't all companies do the same, eliminating the structure differentiation which has been empirically verified? Within that literature [see for example Krueger e Summers (1988), Keane (1993), Blanchflower, Oswald e Sanfey (1996), Abowd, Kramarz and Margolis (1999) e DiNardo, Fortin e Lemieux (1996)], the answer would be that some companies could do that because they gain an income in their market - it is about the rent-sharing hypothesis. The firm would make an income, thus being able to distribute it as it desired. And why would it distribute at least a part of it to their employees? Because, given the wage-efficiency theory, they would produce better quality products (with higher productivity at work).

The hypothesis of our paper fits here. Considering income as the payment of a resource whose responsibility is not modified by the amount of the payment, if there is a permanent restriction or unavailability of the resource, an income is earned by its possessors; if such unavailability is temporary, an almost-rent is earned. Schumpeter (1982) showed that the innovative company, by breaking this circular flow with a new product, can temporarily obtain a monopolist position,

which, according to the previous definition, would make the gain of an almost-income possible, until new companies could also manufacture that product. As Andersen e Lundvall (1988) has showed, this theoretical structure of Schumpeter's had a historical influence at the moment it was formulated, which led its author to consider innovations as the most radical and provocative factors of a discontinuity. Nowadays, however, innovations seem to be more common, which led to the appearance of a whole revolutionary theory of innovations, since Nelson e Winter (1982). Thus, we could suppose that the innovative companies would be becoming able to gain an almost-income, until their innovations became totally standardized and dispersed.

A particular issue for Brazilian companies is scale economies that make it easier for them to export, and exporting companies pay higher wages in Brazil, as showed by De Negri (2003). In the author's analysis, scale would be linked to productivity; workers' productivity is 2.6 times higher in Brazilian export companies than in non-exporting ones. Arbache and De Negri (2002) showed that this wage differentiation is associated not only to the individual characteristics of workers or companies, but also to the fact that the company exports. There would be three groups of explanation for this difference. First, a group of factors which is associated to the wage-efficiency of exporter companies. Second, cultural and organizational aspects of the company: as exporting firms are more exposed to international competition, they would absorb positive external aspects and would also be more motivated to organize their production in a way to be relatively more efficient, taking into account the resources they have. Third, there would be efficiency gain of production scale in relation to non-exporting companies, that is, the wage differentials could be explained by internal productivity dynamics in the company, such as production scale and increasing scale income (De Negri, 2003).

Having these basic theoretical issues in mind, and linking it to a basic typology of companies strategy), we developed a classification of firms in three categories, based on their strategic performance (product innovation and differentiation; standardized products with high productivity; no differentiation and lower productivity). If we could suppose that such performance characteristics depend, in a meaningful way, on the firm's capacity to innovate and on increasing scale incomes, and that these characteristics would make it possible to gain different incomes in its several activities, we could also suppose that there are different ways to motivate (through wage differentials) the workers' efficiency, through the distribution of its respective almost-incomes associated to innovations and to increasing scale incomes. Thus, we could expect that, ceteris paribus (considering firms' and workers' characteristics as a constant), the firms would pay different salaries because of their different strategic performance. More specifically: that the firms that innovate and differentiate their products pay a higher wage premium than the firms which are specialized in standardized products, and that those pay a higher wage premium than the firms that do not differentiate their products and have lower productivity: the first ones would be more innovative and would show more efficiency scale than the second ones, and the second ones, more than the last ones.

To test such hypothesis we build a cross-section regression, for the year of 2000 (the first year of Pintec (Industrial Technological Innovation Survey), indispensable to classify the firms according to the three strategic performance categories.

3. Methodology: how to measure and evaluate wage differentials linked to firms' strategic performance in the Brazilian industry

The first step, prior to the present investigation, was to verify the compatibility among different databases. The main database utilised was Pintec (Pesquisa Industrial – Inovação Tecnológica / Industrial Technological Innovation Survey), from IBGE (Brazilian Institute of Geography and Statistics), that matches all international requirements and is very methodologically consistent. Pintec is fully compatible with PIA/IBGE (Annual Industrial Survey), opening the possibility to joint analyse innovation issues with economic issues of each company. Rais/MTE (Annual Database on Social Information, from the Ministry of Work and Employment, a mandatory database involving all the firms, of all sizes) depicts characteristics of each worker (wages, seniority, years of studies, location etc.), by establishment of each firm; MDIC/Secex, a data base from the Ministry of Development, Industry and External Trade, has information on international trade by firm – prices and quantities imported and exported by product (Mercosul classification - NCM), their origin or destiny etc; and the census of foreign capital by the Central Bank makes possible to categorise capital origins and control. The integration among these databases was done according to the register number of the company at the Ministry of Finance (CNPJ – National Register of Companies), since it is unique and appears in all databases. It makes possible to migrate from one database to another, tracing companies' different characteristics measured by variables available in the different surveys/census. Product differentiation was measured by a 30% premium price regarding the average export price, by class of product, weighted by market share[5], following Mercosul product classification (NCM – Nomenclatura Comum do Mercosul). General descriptive statistics for each category of company according to its strategic performance are shown in table 1.

[5] For instance, a firm can have 100% of Brazilian exports for a product, like Embraer.

Table 1. Wages and characteristics of workers in the Brazilian industry. Year: 2000.

Competitive strategy	Average monthly wage (R$)	Years of study	Time of employment (months)	Wage premium * (%)
Innovate and differentiate products	1.254,64	9,13	54,09	23
Specialised in standardised products	749,02	7,64	43,90	11
No product differentiation and lower productivity	431,15	6,89	35,41	0

Sources: PINTEC/IBGE, PIA/IBGE, RAIS/MTE, MDIC/Secex, Banco Central do Brasil. Elaborated by the authors.

(*) See table 2.

Average wage of firms that innovate and differentiate products are higher than those at firms specialised in standard products, and wages in the later one are higher than in firms that do mote differentiate products and have lower productivity. Schooling is higher according to the same hierarchy, a proxy of the greatest formal capability at firms that innovate and differentiate products. At the same time, the average period of employment is higher ate that type of firms.

Schooling and employment duration are particularly relevant variables to discuss the real competitive strategies pursued by firms. The last one is a proxy of technological and organisational learning; schooling can be also considered as a proxy of firm's technological level, since it is reasonable to assume that firms with higher technological level demand a more skilled workforce.

Although table 1 shows significant differences among the three types of firm (the first three columns), an in-depth analysis must be done (the last column). Regarding wages, the analysis by averages mixes companies of different sizes, income, sectors, location, exposure to international competition etc. It is reasonable to suppose that larger firms pay higher wages, that aeronautical

or car assembly firms pay more than plastic injection or garments firms, that wages in São Paulo State are higher than at Bahia etc.

In order to cope with this problem we will "correct" the wage of each employee by the characteristics of the company and of the worker, aiming at answering the following question: would the firms which innovate and differentiate products pay better wages than firms specialized in standardized products nonetheless, and would those pay better wages than the firms which do not differentiate their products and have lower productivity? We did a cross-section multiple regression[6], the dependent variable being the wage (by hour) of each worker in industry, controlling the main variables that could be related to wage: sector, location (meaning different work markets and different collective contracts with unions), companies' size (income, number of employees), import/export coefficients, investments/income (potential growth), age of the company, age of the workers, years of study (a proxy of skills), etc. Chow's test was utilised (as pointed out by Gujarati, 1995) and adapted for the 3 specific regressions (by firm's strategy).

More specifically, we developed a model to capture the relevant and available characteristics of the firms and the workforce, testing if taken into account the characteristics of firms performing each one of the three strategies described below would they pay different wages. If the interaction of supply and demand were the only regulator of the formation of such salaries, we could not have such differentiation. Contrary to that, if the firms' capacity of gaining incomes is different due to their capacity to innovate (better stating, according to the three strategies), and if they distribute such income amongst their employees (at least partially) because that brings gains in productivity, then it is to be expected that companies from each category have different wages.

[6] We utilised SAS software and its PRO REG procedure, eliminating variables with multicollinearity, and utilising White's heteroscedasticity correction in the SAS (ACOV).

As the classification of firms is based on the Pintec, we had to restrict ourselves to the year of 2000, the only available data at the time of data processing. Therefore, our proposal was to make a cross-section regression, whose variable depends on hour-wage of each employee in the industry and whose explaining variables tried to capture the relevant characteristics of the firms and workers for the analysis. The typical explaining variables were divided into three big groups:

a) Worker characteristics (WC) – variables from Rais, aiming at capturing individual differences of workers.

b) Company characteristics (CC) – variables from Pintec, PIA or the Central Bank, aiming at capturing company differences under many aspects which will be explained further on.

c) Company performance characteristics (CPC) – variables which identify the strategic performance of each company, if it is from the group of firms which innovate and differentiate products, if the company is specialized in standardized products, or if the company is the from the group which does not differentiate its products and has lower productivity.

Thus, our model is: $SH = D + \sum WC + \sum CC + \sum CPC$, where D is the intercept of the cross-section. The explaining WC variables were the following:

i) Period (duration) of employment of the worker – a variable which aims at capturing the experience of the employee in the company where he/she is employed (expected sign: positive);

ii) Period (duration, years) of study of the worker – a variable which aims at capturing the formal qualification of the worker (expected sign: positive);

iii) Worker's age – a variable which aims at capturing the worker experience during his/her whole professional life (expected sign: positive);

iv) Squared worker's age – a variable which aims at capturing the worker's marginal experience gain during his/her whole professional life (expected sign: negative, showing that gains tend to be less proportional as times goes by);

v) Feminine sex – a dummy variable, indicating if the worker is a female (value 1) or a male (value 0), aiming at capturing discrimination in the Brazilian job market against women (expected value: negative);

vi) Kind of worker's occupation – a dummy variable, for the Brazilian Classification of Occupation (CBO) considered to one digit (expected sign: Positive or negative, according to the complexity degree of the occupation, that is, the more complex ones would receive a positive sign, and the others a negative one).

In the worker's characteristics we have not considered the fact that he/she is or is not member of a union, because this important variable unfortunately is neither included in the Rais, which is our database for the worker's characteristics, nor in the others databases. However, the variable is at least partially considered, implicitly, in the company characteristics (CC), in the dummies of the sector and/or of the specified Units of the Federation, since Brazilian Unions are organized by sector and by territory.

The explaining CC variables are the following:

vii) Workforce turnover – a variable which aims at understanding whether the turnover (defined as the change of employees in the same workplace/position, without necessarily having an increase or decrease of jobs/positions in the company) would be cancelling the expected wage prmium or not (expected sign: negative). This variable was calculated according to the definition of The Ministry of Labour and Employment (MTE – Ministério do Trabalho e Emprego)[7];

viii) Size of the company – a dummy variable, in groups (1 to 6) of employed personnel of each company, which aims at capturing if companies of different sizes pay different wages (expected sign: positive or negative, but proportionally increasing according to company size of each range); the 2000 Pintec ranges[8] were used; to this group of variables the restriction that the sum of the coefficients were 0 has been imposed;

ix) Investments in equipments and machines over income – a variable which aims at capturing the growing potential of each company (expected sign: positive);

x) R&D expenses over income – a variable which aims at capturing the innovation effort of each company (expected sign: positive);

xi) Cubic R&D expenses over income - a variable which aims at understanding if the innovation effort grows more or less proportionally with the total R&D expenses (expected sign: negative);

[7] Turnover = [min (Admissions, Hirings)]/[Quantity of employees in 31 December of the previous year].
[8] The ranges are the following: size 1 (from 1 to 29 employees), size 2 (from 30 to 49 employees), size 3 (from 50 to 99 employees), size 4 (from 100 to 249), size 5 (from 250 to 499), and size 6 (500 and more employees).

xii) Foreign Capital / multinational company (foreign capital) – dummy variable to control if the company is controlled by foreigners (value 1) or by Brazilians (value 0);

xiii) geographical localization – dummy variables, which try to understand if there is a location influence (at the State level) in wage formation (expected signs: positive in the States with industrial sectors which pay better salaries and better union structure; and probably negative in the others);

xiv) Sector – dummy variables, by industrial sectors at three digits of the National Classification of Economic Activities (CNAE) of the Brazilian Institute of Geography and Statistics (IBGE), which aims at capturing the wage differentials due to the industrial sector to which the company belongs (expected sign: positive or negative, but higher for sectors which have higher concentration, more technological intensity etc.).

The explaining company performance characteristics (CPC) variables are:

xv) firms which innovate and differentiate products; firms specialized in standardized products with high productivity (similar to the previous category); and firms which do not differentiate products and have lower productivity - dummy variables, representatives of each category, that aim at understanding if firms of each category pay different wages to their employees (expected sign: positive for firms which innovate and differentiate their products and for those which are specialized in standardized products. Negative for the firms which do not differentiate their products and have lower productivity); to this group of variables the restriction of the sum of their coefficients being 0 has been imposed.

All variables, except the dummy ones, have been used in logarithm (including the dependable variable) so that we could capture, in the estimated coefficient, the elasticity associated to each explicative variable. The coefficient of each dummy variable has been transformed in order to indicate how much it means (in percentage) above (positive sign) or below (negative sign) of the average wage-hour of workers of Brazilian industry.

Our econometric procedure used the PRO REG SAS procedure to estimate the equation described below, by eliminating the variables which results by PRO REG showed the existence of multicollinearity, and by using the White's correction heterocedasticity, present at SAS under the name of ACOV. The regressions made were the following:

a) A general regression, that is, regression with all variables;

b) A regression for firms that innovate and differentiate their products, using the same variables of the (c) and (d) regressions below;

c) A regression for firms that are specialized in standardized products, using the same variables of the (c) and (d) regressions; and

d) A regression for firms that do not differentiate their product and have lower productivity, using the same variables of the (b) and (c) regressions.

The regressions from (b) to (d) have been performed in order to compare the specific behaviour of each category and to test if the three categories of firms (according to their strategic performance) structurally show different behaviours – the test used for such inference has been the Chow test (as indicated in Gujarati, 1995) and adapted for three regressions besides the

general ones[9].

Next, we show the results of the cross-section made according to the previously mentioned method and procedures. The results of the location dummies by State (UF), of the sector by CNAE (classification of sectors) to three digits, and of the CBO (classification of jobs) to one digit are shown in the annex. We will first present the results of the general regression and then of the category specific ones.

4. Main results on wage formation in the Brazilian industry

4.1 Some general determinants of wage formation regarding companies and workforce characteristics

The results are presented in Table 2. The dummy coefficients have been converted into percentage, by the formula $C = (e^x - 1).100$, where x is the coefficient without any conversion.

Table 2. Wage formation in the Brazilian industry (dependent variable: wage per hour)

Variable	**Coefficients**	**Std deviation**
constant	-7,917***	0,047
time of employment	0,089***	0,0003
time of study (years)	0,239***	0,0007
age	4,469***	0,025
(age)2	-0,556***	0,004
female (%)	-23,203%***	0,0008
turnover	-0,037***	0,0004
size 1 (%)	2,122%***	0,003

[9] The Chow test has been created to test two groups of a common regression, and not for our case in which we have three regressions. Then, in our procedure we tested each regression against the rest of the sample, thus generating three Chow tests (one of the firms that innovate and differentiate products against the sample of the two remaining groups together; one of the firms specialized in standardized products against the sample of the two remaining groups together; and one of the firms which do not differentiate products and have lower productivity against the sample of the two remaining groups together).

size 2 (%)	-10,237%***	0,002
size 3 (%)	-5,824%***	0,001
size 4 (%)	0,401%***	0,001
size 5 (%)	4,498%***	0,001
size 6 (%)	10,407%***	0,001
investment (equip)/income	0,001***	0,00008
R&D/income	0,073***	0,0007
R&D/(income)3	-0,0001***	0,000001
foreign capital (%)	21,774%***	0,001
Firms that innovate and differentiate products (%)	12,075%***	0,0008
Firms specialised in standardised products (%)	0,703%***	0,0005
Firms without product differentiation and with lower productivity (%)	-11,397%***	0,0007

Sources: PINTEC/IBGE, PIA/IBGE, RAIS/MTE, MDIC/Secex, Banco Central do Brasil. Elaborated by the authors. Year: 2000

R2 = 0,5881; R2 adjust = 0,5881; F-value = 31884,7***; Degrees of freedom = 3390152 ***significant at 1%

One first aspect that calls our attention is that, from the variables referring to worker qualification, the age, a proxy of the professional experience of the worker during his/her whole professional life, is highly elastic. On one hand, that may be related to the fact that our universe of firms is a little biased towards the companies of higher technological content from the Pintec. On the other hand, such elasticity may be related to the fact that for more qualified workers (or for highly qualified ones), the experience during their whole lives is highly valued, which makes that the workers who are considered old for other positions are highly valued. It is important to point out that the squared age elasticity was negative, as expected.

One second aspect is that the elasticity of the time (period, years) of study is very expressive. This may be suggesting that the formal preparation is highly valued by those companies.

One third aspect is related to turnover. Its coefficient is negative, as expected, showing that it tends to reduce the average wage. But its elasticity is much reduced, which may indicate a factor

that is not very important in the alteration of the average wage paid by this kind of firms.

The fourth aspect is about investments in machines and equipments over income. Its coefficient has the expected value, but it is strongly reduced, maybe showing that the growth potential of the company is less important in the development of the average wage of their employees than workers' characteristics.

The fifth aspect refers to R&D over income. Its coefficient is positive as expected, but it is reduced, like the previous one. This result seems intuitive; it could be explained because main characteristics of the workforce in firms that perform R&D are already represented in the other variables and also in the very classification of firms into the three categories of strategic performance. One aspect to point out is the fact that the same variable in cubic has presented a negative coefficient (despite being strongly reduced). That shows that the evolution of the influence of this variable over the average wage is a sigmoid. This is the standard of technology diffusion which is most accepted in the Literature (despite of not being the only one - see, for example, Silverberg, Dosi & Orsenigo, 1988), which may be revealing that the technology diffusion itself has influence on the average wage of the firms - higher and positive are paid by the ones which innovated first, lower or negative by late followers.

A sixth aspect refers to the gender and foreign capital dummies. The expected signs were confirmed, which indicates discrimination in the Brazilian job market against women and the fact that foreigner companies (multinational from other countries) pay better salaries. But what calls one's attention, although being beyond the scope of this study, is that the absolute coefficient magnitude is of the order of 20%, which seems very significant.

One seventh aspect refers to the dummies of the company size. As expected, bigger companies pay higher wages. The exception refers to the smaller size: its coefficient is positive, despite being close to 0, actually indicating that these companies pay salaries which are closer to the total average wage (of the universe). In this group there are companies with high technological specialization which hire a small number of employees, but pay them wages which are higher than the average because they are high qualified workers (the descriptive statistics confirm this inference).

4.2 Firms that innovate and differentiate pay a wage premium

Finally, we have the test to check if the three types of firms (according to strategic performance) pay a wage premium or not. The F test of PROC REG from SAS has been performed in order to verify if the dummy coefficients of each category are statistically equal among themselves, that is, if we can affirm from the statistic point of view that each category establishes a different wage premium. The result was affirmative, with 1% significance for all tests carried out[10]. This means that firms which innovate and differentiate products pay a wage premium of 12,075%; firms specialized in standardized products would pay a premium of 0,703% (in fact, they would not pay any wage premium) firms which do not differentiate products and have lower productivity would pay wages 11,397% smaller than the global average. These results mean that the theoretical expectations are validated for an emerging country like Brazil – the benefits of innovation and product differentiation on wages are not only a theoretical observation taking into account developed economies.

Besides, we can say that those results show that public policies that motivate companies to

[10] The outputs of the tests are: for the firms which innovate and differentiate products against the firms specialized in standardized products, F= 10723,6; for the firms which innovate and differentiate products against the firms that differentiate products and have lower productivity, F= 30298,1; and for the firms specialized in standardized products against the firms which do not differentiate products and have lower productivity, F= 17618,7.

improve their productive performance towards innovation have a beneficial social effect to raise the average wages, independently of the other relevant factors in wage formation in the market.

The regressions made only with workers of the firms of each category isolated are presented at table 3. All variable signs matched the expected sign.

Table 3. Wage formation in Brazilian industry by competitive strategy of firms Year:2000

Variable	**Firms that innovate and differentiate products**	**Standard deviation Firms that innovate and differentiate products**	**Firms specialised in standardised products**	**Standard deviation - Firms specialised in standardised products**	**Firms without product differ. and lower productivity**	**Std. deviation Firms without product differ. and with lower productivity**
constant	-11,508***	0,125	-7,401***	0,054	-4,885***	0,081
time of employment	0,095***	0,0007	0,094***	0,0003	0,072***	0,0005
years of study	0,292***	0,002	0,273***	0,0009	0,160***	0,001
age	6,599***	0,072	4,250***	0,031	3,388***	0,045
$(age)^2$	-0,838***	0,011	-0,526***	0,005	-0,419***	0,007
female (%)	-23,203%***	0,002	-23,891%***	0,0009	-19,184%	0,002
turn over	-0,028***	0,001	-0,076***	0,0006	-0,021***	0,0008
size 1	23,739%***	0,012	-1,587%***	0,004	-3,149%***	0,004
size 2	-6,106%***	0,018	-8,424%***	0,004	-8,149%***	0,003
size 3	-10,147%***	0,023	-4,877%***	0,002	-4,877%***	0,002
size 4	-5,257%***	0,005	0,301%***	0,001	1,005%***	0,002
size 5	-2,078%***	0,005	4,812%***	0,001	4,289%***	0,002
size 6	3,355%***	0,005	10,960%***	0,001	12,187%***	0,002
investment-equip./income	0,007***	0,0003	0,0005***	0,0001	0,0007***	0,0001
R&D/income	0,069***	0,002	0,065***	0,0009	0,162***	0,002
$R\&D/(income)^3$	-0,0001***	0,000004	-0,0001***	0,000001	-0,0003***	0,000004
foreign company (%)	23,986%***	0,002	17,704%***	0,001	19,244%***	0,005
Firms that innovate and differentiate products: R2 = 0,5538; R2adjust = 0,5537; F – value = 5639,05***; Degrees of freedom = 595407.						
Firms specialised in standardised products: R2 = 0,5820; R2adjust = 0,5819; F – value = 22920,4***; Degrees of freedom = 2160131.						
Firms without product differ. and lower product. : R2 = 0,4828; R2adjust = 0,4827; F – value = 4576,71***; Deg. of freedom = 642385.						

Sources: PINTEC/IBGE, PIA/IBGE, RAIS/MTE, MDIC/Secex, Banco Central do Brasil. Elaborated by the authors. ** significant at 1%

Comparing the elasticities, those related to workers' experience are higher in firms that innovate and differentiate products than in firms specialized in standardized products, and are higher in these firms than in firms which do not differentiate products and have lower productivity. That result seems logical, since the firms that innovate and differentiate products, in average presenting more technological density than the firms specialized in standardized products, and higher in the latter than in the firms which do not differentiate products and have lower productivity.

Turnover also presents the expected signs. The same happens to the size of the company per category, with the relevant fact that companies of smaller size (size 1) present a higher value than the superior size companies (size 2) for all categories. That confirms the results obtained in the regression for all categories together, in which size 1 indicates higher salaries than sizes 2, 3, and 4, that is, the companies of smaller size seems to be more sophisticated, hiring more qualified workers (such perception have been confirmed by descriptive statistics) and, then, tend to pay higher wages, mainly the smaller companies that innovate and differentiate their products. Another relevant characteristic is R&D over income, which presents the expected signs, but with higher elasticity for firms that do not differentiate products and have lower productivity. The hypothesis for such difference relates to the fact that the expenses on R&D is rarer in that kind of firms than in those specialized in standardized products and in those that innovate and differentiate products, which may mean that the effect of such expenses over the average wage is higher for the firms that do not differentiate their products and have lower productivity.

One last statistic related to these results refers to Chow's test in order to verify if the regressions of each category are structurally different. The result shows a favourable value of this test[11].

[11] The values of the three Chow tests were the following: for the firms which innovate and differentiate their products against firms which do not differentiate products and have lower productivity F= 1141,47 (significant to

That way, we can say that there is a statistical indication that the firms of each category formulate wages in a differentiated way among themselves.

5. Contribution to public policies

It is not the focus to revise the literature on industrial or innovation policies, but some contributions to the debate could be highlighted. In the previous section we demonstrated that we can statistically infer that there is a structural difference among the industrial firms of the three categories. This conclusion is relevant because it suggests that public policies which are differentiated according to companies' performance, and not necessarily according to sector, could be beneficial for the competitiveness of the Brazilian industry.

Brazil, as well as some other emerging countries, has a huge social inequality. This inequality is being reduced due to specific policies set by Lula's government, like rent transferring known as "Bolsa Família" (Family Grant) if children are assiduous to school, and the elevation of the minimum wage. Our findings go in the same direction: policies to boost innovation in companies have a positive effect on wages. It is a good finding for emerging countries: innovation policies and distribution polices can be compatible.

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1% level), for the firms which innovate and differentiate products against the firms specialized in standardized products, F= 1096,10 (significant to 1% level), and for the firms which are specialized in standardized products against the firms which do not differentiate products and have lower productivity, F= 967,08 (significant to 1% level).

without violation to the legal and necessary confidentiality of individual companies' data.

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ANNEX

Table A. Wage formation in the Brazilian industry: location, sector and job classification
Dependent variable: wage per hour Year: 2.000

Variable	**Coefficients**	**Std deviation**	**Significance Level**
States (Unity of Federation)			
SP	0,339	0,002	1%
MG	-0,004	0,003	10%
RJ	0,134	0,003	1%
ES	0,101	0,004	1%
PR	0,074	0,003	1%
SC	0,142	0,003	1%
RS	0,147	0,003	1%
AC	-0,155	0,020	1%
AL	-0,065	0,003	1%
AM	-0,007	0,004	10%
AP	0,162	0,027	1%

BA	-0,065	0,003	1%
CE	-0,288	0,003	1%
DF	0,244	0,006	1%
GO	-0,067	0,003	1%
MA	0,009	0,005	10%
MS	0,031	0,004	1%
MT	0,091	0,004	1%
PA	-0,027	0,004	1%
PB	-0,214	0,004	1%
PI	-0,328	0,005	1%
RN	-0,338	0,004	1%
RO	0,055	0,006	1%
RR	0,082	0,048	10%
SE	-0,071	0,005	1%
PE	0,032	0,003	1%
TO	-0,014	0,011	ns
Sector			
Cnae100	0,436	0,021	1%
Cnae112	0,837	0,023	1%
Cnae131	0,801	0,020	1%
Cnae132	0,430	0,021	1%
Cnae141	0,119	0,020	1%
Cnae142	0,221	0,021	1%
Cnae151	-0,084	0,020	1%
Cnae152	-0,135	0,020	1%
Cnae153	0,102	0,020	1%
Cnae154	0,084	0,020	1%
Cnae155	0,022	0,020	ns
Cnae156	0,154	0,020	1%
Cnae157	-0,014	0,020	ns
Cnae158	0,052	0,020	1%
Cnae159	0,213	0,020	1%
Cnae160	-0,263	0,020	1%
Cnae171	0,132	0,027	1%
Cnae172	-0,121	0,020	1%
Cnae173	-0,077	0,020	1%
Cnae174	-0,006	0,020	ns
Cnae175	0,129	0,020	1%
Cnae176	-0,014	0,020	ns
Cnae177	0,021	0,020	ns
Cnae181	-0,012	0,020	ns
Cnae182	0,052	0,021	ns
Cnae191	-0,032	0,020	ns
Cnae192	-0,118	0,020	1%
Cnae193	-0,147	0,020	1%
Cnae201	-0,193	0,020	1%
Cnae202	-0,110	0,020	1%
Cnae132	0,430	0,021	1%
Cnae141	0,119	0,020	1%
Cnae142	0,221	0,021	1%
Cnae151	-0,084	0,020	1%

Cnae152	-0,135	0,020	1%
Cnae153	0,102	0,020	1%
Cnae154	0,084	0,020	1%
Cnae155	0,022	0,020	ns
Cnae156	0,154	0,020	1%
Cnae157	-0,014	0,020	ns
Cnae158	0,052	0,020	1%
Cnae159	0,213	0,020	1%
Cnae160	-0,263	0,020	1%
Cnae171	0,132	0,027	1%
Cnae172	-0,121	0,020	1%
Cnae173	-0,077	0,020	1%
Cnae174	-0,006	0,020	ns
Cnae175	0,129	0,020	1%
Cnae176	-0,014	0,020	ns
Cnae177	0,021	0,020	ns
Cnae181	-0,012	0,020	ns
Cnae182	0,052	0,021	ns
Cnae191	-0,032	0,020	ns
Cnae192	-0,118	0,020	1%
Cnae193	-0,147	0,020	1%
Cnae201	-0,193	0,020	1%
Cnae202	-0,110	0,020	1%
Cnae211	0,761	0,021	1%
Cnae212	0,177	0,020	1%
Cnae213	0,170	0,020	1%
Cnae214	0,080	0,020	1%
Cnae221	0,390	0,020	1%
Cnae222	0,290	0,020	1%
Cnae223	0,116	0,023	1%
Cnae232	1,277	0,020	1%
Cnae234	0,260	0,020	1%
Cnae241	0,368	0,020	1%
Cnae242	0,613	0,020	1%
Cnae243	0,692	0,021	1%
Cnae244	0,137	0,022	1%
Cnae245	0,426	0,020	1%
Cnae246	0,373	0,023	1%
Cnae247	0,076	0,020	1%
Cnae248	0,384	0,020	1%
Cnae249	0,268	0,020	1%
Cnae251	0,080	0,020	1%
Cnae252	0,051	0,020	1%
Cnae261	0,124	0,020	1%
Cnae262	0,446	0,020	1%
Cnae263	0,163	0,020	1%
Cnae264	0,057	0,020	1%
Cnae269	0,063	0,020	1%
Cnae271	0,635	0,020	1%
Cnae272	0,212	0,020	1%

Cnae211	0,761	0,021	1%
Cnae212	0,177	0,020	1%
Cnae213	0,170	0,020	1%
Cnae214	0,080	0,020	1%
Cnae221	0,390	0,020	1%
Cnae222	0,290	0,020	1%
Cnae223	0,116	0,023	1%
Cnae232	1,277	0,020	1%
Cnae234	0,260	0,020	1%
Cnae241	0,368	0,020	1%
Cnae242	0,613	0,020	1%
Cnae243	0,692	0,021	1%
Cnae244	0,137	0,022	1%
Cnae245	0,426	0,020	1%
Cnae246	0,373	0,023	1%
Cnae247	0,076	0,020	1%
Cnae248	0,384	0,020	1%
Cnae249	0,268	0,020	1%
Cnae251	0,080	0,020	1%
Cnae252	0,051	0,020	1%
Cnae261	0,124	0,020	1%
Cnae262	0,446	0,020	1%
Cnae263	0,163	0,020	1%
Cnae264	0,057	0,020	1%
Cnae269	0,063	0,020	1%
Cnae271	0,635	0,020	1%
Cnae272	0,212	0,020	1%
Cnae273	0,212	0,020	1%
Cnae274	0,353	0,020	1%
Cnae275	0,117	0,020	1%
Cnae281	0,340	0,020	1%
Cnae282	0,275	0,021	1%
Cnae283	0,272	0,020	1%
Cnae284	0,162	0,020	1%
Cnae289	0,205	0,020	1%
Cnae291	0,224	0,020	1%
Cnae292	0,260	0,020	1%
Cnae293	0,070	0,020	1%
Cnae294	0,326	0,020	1%
Cnae295	0,183	0,020	1%
Cnae296	0,397	0,020	1%
Cnae297	0,163	0,021	1%
Cnae298	0,099	0,020	1%
Cnae301	0,428	0,022	1%
Cnae302	0,320	0,021	1%
Cnae311	0,289	0,020	1%
Cnae312	0,290	0,020	1%
Cnae313	0,149	0,020	1%
Cnae314	0,115	0,020	1%
Cnae315	-0,006	0,021	ns

Cnae316	0,087	0,020	1%
Cnae319	0,170	0,021	1%
Cnae321	0,271	0,020	1%
Cnae322	0,710	0,020	1%
Cnae323	0,175	0,020	1%
Cnae331	-0,013	0,020	ns
Cnae332	0,090	0,020	1%
Cnae333	0,324	0,020	1%
Cnae334	0,034	0,021	10%
Cnae335	0,308	0,023	1%
Cnae341	0,366	0,020	1%
Cnae342	0,451	0,020	1%
Cnae343	0,222	0,020	1%
Cnae344	0,198	0,020	1%
Cnae345	-0,131	0,023	1%
Cnae351	0,279	0,022	1%
Cnae352	0,265	0,021	1%
Cnae353	0,562	0,020	1%
Cnae359	0,145	0,020	1%
Cnae361	-0,047	0,020	5%
Cnae369	-0,095	0,020	1%
Cnae371	0,050	0,023	5%
Job Classification			
CBO1	0,279	0,004	1%
CBO2	0,751	0,004	1%
CBO3	0,016	0,001	1%
CBO4	0,207	0,002	1%
CBO5	-0,424	0,002	1%
CBO6	-0,420	0,002	1%
CBO7	-0,221	0,0008	1%
CBO8	-0,189	0,0009	1%

Sources: PINTEC/IBGE, PIA/IBGE, RAIS/MTE, MDIC/Secex, Banco Central do Brasil. Elaborated by the authors
Obs: ns = no significance.